REMARKS

Claims 1-13 are pending in this application with claim 1 being amended by this response.

Claim 1 is amended to provide further clarification of the present invention. Specifically, this formal amendment clarifies the motion vector field for a single image and the motion vector field between two images. Amended claim 1 specifies that the motion vector field for said current image corresponds to a motion estimation between this current image and a previous image and that the motion vector field for a preceding image corresponds to a motion estimation between this preceding image and a further preceding image. Support for this amendment can be found throughout the specification and specifically in Figure 4 and the corresponding description on page 6, line 31 – page 7, line 24. Thus, it is respectfully submitted that no new matter is added by this amendment.

Rejection of Claims 1-4, 7, 10 and 11 under 35 USC § 103

Claims 1-4, 7, 10 and 11 remain rejected under 35 USC § 103(a) as being unpatentable over Kerdranvrat in of Lee.

The present claimed invention describes a method of movement estimation for a sequence of images including segmentation of a current video image into image blocks. Movement estimation occurs per image block between the current image and a previous image in order to obtain a movement vector field for the current image. A stage of reassignment of a vector to a block occurs by selecting one movement vector from among N predominant vectors. The predominant vectors are the ones of the group of vectors belonging to the movement vector field for the current image and at least to the movement vector field for a preceding image corresponding to a movement vector field between the preceding image and a further preceding image. The vectors are scaled according to the temporal distance to which they correspond.

An important distinction between the present claimed invention and the systems disclosed by either Kerdranvrat or Lee alone or in combination with one another lies in the definition of a motion vector field. In Kerdranvrat and Lee, a motion

vector field for a current image is determined by calculating a motion between the current image and another image which is usually known as the reference image. For each pixel of the current image or for each block of the current image, a correlation with the pixels or blocks of the other image is performed to determine a motion. The motion vector field for the current image is consequently obtained by calculating a motion between two images.

This is unlike the present claimed invention which utilizes a first motion vector field for a current image and a second motion vector field for a preceding image. Therefore, a first motion estimation is performed between the "current image" and "a preceding image" and a second motion estimation is performed between "said preceding image" and "a further preceding image". Thus, by performing the claimed motion estimation, the present claimed invention obtains the two motion vector fields.

Kerdranvrat discloses that a motion vector characterizes a displacement between an image and a previous image (see Kerdranvrat, col.2 lines 9-19). Specifically, Kerdranvrat merely discloses "extraction of a set of dominant vectors from the nxn blockwise field of vectors which already comprises a reduced number of vectors". This is unlike the method of the present claimed invention as it merely takes into account the current image. Thus, the motion vector displacement conducted by Kerdranvrat neither discloses nor suggests "a stage of reassignment of a vector to a block by selecting one movement vector from among N predominant vectors" as in the present claimed invention. Furthermore, Kerdranvrat neither discloses nor suggests that "the predominant vectors are the ones of the group of vectors belonging to the movement vector field for said current image and at least to the movement vector field for a preceding image corresponding to a movement between said preceding image and further preceding image" as in the present claimed invention. Thus, it is clear that this "stage of reassignment" which utilizes two motion vector fields is NOT equivalent to the calculation of a motion between a current image and a previous image as disclosed by Kerdranvrat.

The Final Office Action refers to the vector filtering, as disclosed on column 10, lines 18-45 and the corresponding Figure 11, as meeting the claimed "stage of reassignment". Applicants respectfully disagree. Specifically, Kerdranvat discloses a time filtering and a comparison between the first Nmax vectors of the table SORT and those which were extracted as dominant vectors for the preceding image (see col. 7, lines 11 – 22). This is wholly unlike the "stage of reassignment" as in the present claimed invention due to the difference in the range of motions able to be obtained by the present claimed invention as compared to those obtained by Kerdranvrat.

Kerdranvrat calculates motion vectors by calculating a histogram for a current image and combines the current image histogram with a histogram of a previous image. On the other hand, the present claimed invention utilizes a single histogram. As previously stated, the choice of "one movement vector from among N predominant vectors" is performed using a single histogram. Specifically, in the present claimed invention, the use of a histogram (the choice of predominant motion vectors) takes into account more than one motion vector field to obtain the "spatial" dominant motions in the current image as well as the "temporal" dominant motions (due to the temporal filtering obtained by taking into account several images in the sequence). Therefore, the combination of multiple histograms as disclosed by Kerdranvrat is unlike the present claimed invention which uses a single histogram

The advantage of choosing predominant motion vectors among vectors belonging to two or more motion vector fields as in the present invention (i.e. a single histogram for more than one image) is to achieve increased coherence between the motion fields of successive images. Thus, the calculation of backward and forward motion vectors of a B image can be made by taking into account the motion vector field between the P images framing the B image, increasing, in this way, the "signal to noise ratio" of the motion vector fields and reducing the cost of coding while simultaneously improving coherence due to the fact that the coding is a differential coding.

In other words, Kerdranvrat selects vectors from a first histogram, then vectors from a second histogram and performs a filtering among the selected vectors. This is wholly unlike the present claimed invention which performs "a stage of reassignment" and uses only one histogram wherein the filtering is performed "by selecting one movement vector from among N predominant vectors", i.e. all the motion vectors, contained in the two motion vector fields.

Additionally, Kerdranvrat in col. 2 lines 9-19 or col. 3, lines 30-40, neither discloses nor suggests a "movement vector field for said current image and at least to the movement vector field for a preceding image corresponding to a movement vector field between said preceding image and a further preceding image" as in the present claimed invention. Rather, what is disclosed in the above sections of Kerdranvrat are segmenting the field of an image by assigning the best motion vector to a block and extracting a set of dominant vectors from these reduced number of best vectors. This clearly involves only a single unitary image and neither discloses nor suggests "a stage of reassignment" as in the present claimed invention. Furthermore, the dominant vector selected by Kerdranvrat is unlike present claimed invention "wherein the predominant vectors are the ones of the group of vectors belonging to the movement vector field for said current image and at least to the movement vector field for a preceding image corresponding to a movement between said preceding image and further preceding image".

Furthermore, in response to the comments on page 3 in the Office Action stating that Kerdranvrat, in col 5, lines 12-68 and col.6, lines 1-30, uses pointwise field of motion and the resultant histogram would be used to classify vectors between two successive images and thus discloses histogram used the present claimed invention. Applicants respectfully disagree. In fact, the histogram that is used in the pointwise field of motion of Kerdranvrat neither discloses nor suggest the use of two motion vector fields as in the present claimed invention.

This novel element of the present claimed invention is clarified in the amendments to claim 1. Specifically, the present claimed invention recites that "the predominant vectors are the ones of the group of vectors belonging to the movement

vector field for said current image and at least to the movement vector field for a preceding image corresponding to a movement vector field between said preceding image and a further preceding image". Kerdranvrat utilizes a histogram to classify vectors between two successive images, which is unlike the present claimed invention which uses a histogram relating to three or more images due to the use of more than ONE motion vector field, i.e. movement vector fields for a current image and a preceding image and a movement vector field for a preceding image and a further preceding image. This feature is neither disclosed or suggested by Kredranvrat.

In conclusion, Kerdranvat discloses a histogram to classify vectors between two images but fails to disclose the merge of two motion vector fields corresponding to two temporally different images (current image / preceding image) for calculating a histogram. Thus, it is respectfully submitted that Kerdranvrat neither discloses nor suggests the "stage of reassignment" of the present claimed invention.

Lee discloses an image encoding scheme in which two or more different sets of motion vectors are generated for each image that is to be encoded using motion estimation. Similarly to Kerdranvrat, Lee also neither discloses nor suggests "a stage of reassignment of a vector to a block by selecting one movement vector from among N predominant vectors, wherein the predominant vectors are the ones of the group of vectors belonging to the movement vector field for said current image and at least to the movement vector field for a preceding image corresponding to a movement between said preceding image and further preceding image" as in the present claimed invention. In fact, there is no suggestion in Lee regarding merging the two motion vector fields as in the present invention.

Applicants further respectfully submit that any system resulting from a combination of Kerdranvrat with Lee would not produce the system of the present claimed invention. Specifically, as neither Kerdranvrat and Lee disclose or suggest "method of movement estimation for a sequence of images" that includes "a stage of reassignment of a vector to a block by selecting one movement vector from among N predominant vectors, wherein the predominant vectors are the ones of the group of vectors belonging to the movement vector field for said current image and at least to

the movement vector field for a preceding image corresponding to a movement between said preceding image and further preceding image". The resulting combined system of Kerdranvrat and Lee would not utilize two motion vector fields as in the present claimed invention. The system would operate to classify vectors between successive images and thus would not be able to reassign vectors as in the present claimed invention due to the combined systems inability to take into account movement vector fields for a current image and a preceding image and a preceding image and a further preceding image. Therefore, applicants respectfully submit that the combination of systems disclosed by Kerdranvrat and Lee does not produce the present claimed invention.

In view of the above remarks and amendments to claim 1, it is respectfully submitted that Kerdranvrat when taken alone or in combination with Lee provides no 35 USC 112 compliant enabling disclosure that makes the present claimed invention obvious. As claims 2 – 13 are dependent on independent claim 1, it is respectfully submitted that claims 2 – 13 are also not obvious in view of Kerdranvrat and Lee for the same reasons above concerning claim 1. Thus, it is respectfully submitted that this rejection has been satisfied and should be withdrawn.

Having fully addressed the Examiner's rejections, it is believed that, in view of the preceding amendments and remarks, this application stands in condition for allowance. Accordingly then, reconsideration and allowance are respectfully solicited. If, however, the Examiner is of the opinion that such action cannot be taken, the Examiner is invited to contact the applicants' attorney at the phone number below, so that a mutually convenient date and time for a telephonic interview may be scheduled.

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Respectfully submitted,

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